

CLAIM AMENDMENTS

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims

- 1 1. (Currently Amended) A redundant hub-spoke configuration for a virtual
2 private LAN (VPN) of the type having a plurality of emulated LANs (ELANs), each
3 connected at a provider edge (PE) node over a service provider network, comprising:
4 a first hub node serving client equipment (CE) devices connected on a first ELAN,
5 a spoke node serving CE devices on a second ELAN;
6 a first point-to-point link L1 for interconnecting said first hub node and said spoke
7 node; and
8 a second hub node interconnected with said first hub node,
9 wherein whenever said first link L1 fails, said second hub node establishes
10 communication with said spoke node over a second point-to-point link L2.
- 1 2. (Currently Amended) The redundant hub-spoke configuration of claim 1,
2 wherein said second hub node operates as a spoke node of first said hub node under normal
3 operation conditions.
- 1 3. (Original) The redundant hub-spoke configuration of claim 1, wherein said
2 first hub node operates as a spoke node of said second hub node when said first hub node
3 fails.
- 1 4. (Original) The redundant hub-spoke configuration of claim 1, wherein a first
2 PE node interfacing said first hub with said service provider network monitors said first link
3 L1 for detecting a failure at said hub node.
4
- 1 5. (Currently Amended) The redundant hub-spoke configuration of claim 1,
2 wherein in case of a failure at said first hub node, said first PE node signals to a third PE

3 node interfacing said spoke node with said service provider network to establish a second
4 point-to-point link with said second hub node, and to re-map the traffic from said second hub
5 node over said second point-to-point link.

1 6. (Original) The redundant hub-spoke configuration of claim 1, wherein the
2 access link between said spoke node and said third PE node is an aggregated bundle of links
3 comprising a redundant link.

1 7. (Original) The redundant hub-spoke configuration of claim 6, wherein
2 connectivity between said third PE node and said spoke node is maintained when a link on
3 said respective aggregated bundle is interrupted.

1 8. (Original) The redundant hub-spoke configuration of claim 7, wherein the
2 loss of a link in said aggregated bundle is transparent to said spoke node.

1 9. (Original) In a hub-spoke configuration for a virtual private LAN (VPN) of
2 the type having a plurality of emulated LANs (ELANs), each connected at a service provider
3 edge (PE) node over an access link, a method for recovering the traffic in case of a failure,
4 comprising:

5 a) transmitting traffic from a first hub node to a spoke node over a first point-to-point
6 link established between a first PE at said first hub node and a third PE at said spoke node;

7 b) at said third PE, monitoring the traffic on said first link;

8 c) responsive to a fault on said link, signaling said fault from said third PE to said first
9 PE; and

10 d) transmitting traffic from a second hub node to said spoke node over a second
11 point-to-point link established between a second PE node at said second hub node and said
12 third PE.

1 10. (Original) The method of claim 9, wherein step a) comprises:

2 at said first hub node, bridging the traffic destined to said spoke node towards said
3 first PE;

4 at said first PE, tunneling the traffic received from said first hub node along said
5 point-to-point connection to said third PE,
6 at said third PE, mapping the traffic received over said point-to-point connection to
7 said spoke node; and
8 at said spoke node, bridging the traffic received from said third PE.

1 11. (Original) The method of claim 9, wherein step a) comprises:
2 at said second hub node, bridging the traffic destined to said spoke node towards said
3 third PE;
4 at said second PE, tunneling the traffic received from said second hub node along said
5 second point-to-point connection to said third PE,
6 at said third PE, mapping the traffic received over said second point-to-point
7 connection to said spoke node; and
8 at said spoke node, bridging the traffic received from said third PE.

1 12. (Original) The method of claim 9, wherein said step c) comprises using a
2 Layer1 signaling protocol.

1 13. (Original) The method of claim 9, wherein said second hub node operates as
2 a spoke node of said first hub node under normal operation conditions.

1 14. (Original) The method of claim 9, wherein said first hub node operates as a
2 spoke node of said second hub node when said hub node fails.

1 15. (Original) The method of claim 9, wherein first and second point-to-point
2 connections are point-to-point Ethernet tunnels.

1 16. (Original) The method of claim 9, wherein the access link between said third
2 PE and said spoke is an aggregated bundle of links comprising a redundant link.

1 17. (Original) The method of claim 16, wherein connectivity between third PE
2 node and said spoke node is maintained when a link on said aggregated bundle is interrupted.

1 18. (Original) The method of claim 17, wherein the loss of a link in said
2 aggregated bundle is transparent to said spoke node.

1 19. (Withdrawn) A method of providing a multipoint emulated LAN connecting
2 a plurality of sites with site-to-site bandwidth guarantees, comprising:
3 configuring a second customer located equipment PLE to perform multipoint
4 switching of the traffic in a first VC/tunnel established between a first site and said second
5 site, to one of a second or a third site, based on the MAC address;
6 configuring a first CLE to operate as a spoke of said first CLE to perform point-to-
7 point switching of said first VC/tunnel, and of a second VC/tunnel established between said
8 third site and said second site; and
9 allocating a first bandwidth to said first VC/tunnel and a second bandwidth to said
10 second VC/tunnel and rate limiting traffic in each said first VC/tunnel and said second
11 VC/tunnel to said respective allocated bandwidth.

1 20. (Withdrawn) In a virtual private LAN (VPL) of the type having a plurality of
2 emulated LANs, each emulated LAN comprising an access device connected to a service
3 provider edge PE node along an access link identified by a data link connection identifier,
4 and a first PE is interconnected with a second PE along a point-to-point link, a method of
5 establishing a hybrid connection between a first customer equipment CE device on said VPL
6 and a second CE device that operates according to a different communication protocol, said
7 method comprising:
8 a) at said second CE device, performing bridged encapsulation of the traffic and
9 transmitting a second type protocol data unit (PDU) over a second access link to a second
10 provider edge (PE) node;
11 b) at said second PE node, decapsulating traffic from said PDU, and transmitting the
12 traffic into a service provider type PDU over a dedicated point-to-point tunnel across said
13 service provider network to a first PE node;

11 b) at said second PE node, decapsulating traffic from said PDU, and transmitting the
12 traffic into a service provider type PDU over a dedicated point-to-point tunnel across said
13 service provider network to a first PE node;

14 c) at said first PE node, decapsulating the traffic from said service provider PDU,
15 converting it to a first type PDU and transmitting said PDU to a first access device over a
16 first access link;

17 d) at said first access device, bridging said PDU to said first CE device.

1 21. (Withdrawn) The method of claim 20, wherein said first access link is
2 differentiated at said first access device by a dedicated first data link connection identifier
3 DCLI, and said second access link is differentiated at said second PE node by a dedicated
4 second DCLI.

1 22. (Withdrawn) In a VPL of the type having a plurality of emulated LANs, each
2 emulated LAN comprising an access link to a service provider edge PE node identified by a
3 data link connection identifier, a method of establishing a hybrid connection between a first
4 customer equipment CE device on said VPL and a second CE device that operates according
5 to a different communication protocol, said method comprising:

6 a) at said first CE device, bridging a first type PDU to a first PE node over a first
7 access link;

8 c) at said first PE node, decapsulating traffic from said first type PDU, encapsulating
9 the traffic into a service provider type PDU and transporting it over a dedicated point-to-
10 point tunnel across said service provider network to a second PE node; and

11 d) at said second PE, decapsulating traffic from said service-provider PDU,
12 performing bridged encapsulation of the traffic in a second type PDU and sending it to said
13 second CE device over a second access link.

1 23. (Withdrawn) The method of claim 22, wherein said first access link and said
2 second access link of said hybrid connection are distinct from access links for a
3 homogeneous connections between any CE devices operating according to said first
4 communication protocol.

1 24. (Withdrawn) The method of claim 22, where said first communication
2 protocol is Ethernet and said second communication protocol is one of Frame Relay and
3 ATM.

1 25. (Withdrawn) The method of claim 22, wherein said second type PDU is an
2 FR frame or an ATM cell, and said service provider type PDU is an IP packet of an IP
3 Layer2 Transport type.

1 26. (Withdrawn) The method of claim 24, wherein step c) comprises:
2 provisioning the network address of said second CE device at said first PE node;
3 at said first CE, sending an ARP request to said first PE node for the IP destination
4 address of said second CE device,
5 receiving the MAC address of said PE node if said second device is connected to said
6 second PE node.

1 27. (Withdrawn) The method of claim 25, wherein said second PE device uses
2 Inverse ARP capabilities to discover the network address of said second CE device.

1 28. (Withdrawn) The method of claim 25, wherein said first PE node uses
2 signaling to provide said first CE device with the network address of said second CE device.

1 29. (Withdrawn) In a VPL of the type having a plurality of emulated LANs, each
2 emulated LAN comprising an access link to a service provider edge PE node identified by a
3 data link connection identifier, a method of establishing a hybrid connection between a first
4 customer equipment CE device on said VPL and a second CE device that operates according
5 to a different communication protocol, said method comprising:

6 a) at said second CE device, performing routed encapsulation of traffic into a second
7 type PDU and transmitting said second type PDU to a second PE node over a second access
8 link;

9 b) at said second PE node, decapsulating traffic from said second type PDU,
10 encapsulating the traffic into a subscriber network type PDU and transmitting it over a
11 dedicated point-to-point tunnel to a first PE node;
12 c) at said first PE node, decapsulating the traffic received over said dedicated point-
13 to-point tunnel, encapsulating it into a first-type PDU, and sending first-type PDU to an
14 access device over a second access link; and
15 at said access device, bridging said PDU to said first CE device.

1 30. (Withdrawn) The method of claim 29, wherein said first CE device is an IP
2 router and said second device is a FR or ATM router.

1 31. (Withdrawn) The method of claim 30, wherein step c) comprises
2 sending from said first PE node a proxy ARP request to said first access device over
3 said first access link;
4 receiving in a response ARP request the MAC address corresponding to the IP
5 address of said first-type PDU; and
6 transmitting said first-type PDU to said first CE device based on said MAC address.

1 32. (Withdrawn) The method of claim 31, further comprising caching said MAC
2 address at said first PE node.

1 33. (Withdrawn) The method of claim 31, wherein if said first CE device is on an
2 emulated LAN served by said second PE node, said first CE device sends said response ARP
3 directly to said second PE device.

1 34. (Withdrawn) The method of claim 29, wherein said first CE device is an IP
2 router enabled with an IRDP protocol (Internet Control Message Protocol Router Discovery
3 Protocol) and said second device is a FR or ATM router.

1 35. (Withdrawn) The method of claim 34, wherein step c) comprises: listening at
2 said first PE node for advertisement messages issued by said first CE on said first access link;

3 discovering the MAC address of said first CE device and transmitting said first-type PDU to
4 said first CE device based on said MAC address.

1 36. (Withdrawn) The method of claim 35, further comprising caching said MAC
2 address at said first PE node.

1 37. (Withdrawn) The method of claim 34, wherein when said MAC address
2 identifies a non-optimal router, step c) further comprises sending a redirect message to said
3 second PE with the address of said optimal router so that subsequent PDUs are sent to
4 optimal router.